



TRANSPORTATION RESEARCH BOARD

OF THE NATIONAL ACADEMIES

October 21, 2010

Vincent Valdes
Associate Administrator for Research,
Demonstration and Innovation
Federal Transit Administration
United States Department of Transportation
1200 New Jersey Ave, SE
Washington, DC 20590

Dear Mr. Valdes,

On August 19–20, 2010, the Transit Research Analysis Committee (TRAC) convened at your request a series of technical sessions consisting of presentations and panel discussions about transit safety needs and related research opportunities. The meeting agenda and list of participants are included in Attachment A. I wish to express special thanks for the introductory remarks made by Therese McMillan, the presentation given by FTA's Safety Director Michael Flanigan, and the active participation of Federal Transit Administration (FTA) staff, especially yourself and Deputy Associate Administrator Bruce Robinson.

The June 22, 2009, crash of two trains operated by the Washington Metropolitan Area Transit Authority (WMATA), which resulted in nine dead and dozens of injured riders, has drawn national attention to the issue of rail transit safety performance and government oversight. The administration has encouraged Congress to enact legislation that would require FTA to regulate the safe operations of transit services, and similar legislation has been introduced in both houses of Congress. Should such legislation be enacted, it would have broad implications for FTA in general and for the Office of Research, Demonstration and Innovation (RDI) in particular. The technical sessions

were designed to help RDI as it considers further the kinds of safety research it should be pursuing, particularly if the agency assumes a more prominent role in safety assurance.

At your request, TRAC has prepared this letter report to advise RDI on appropriate next steps in supporting FTA and transit safety activities, including the identification of some early and promising areas of research. TRAC's standing charge is to "provide an independent review and assessment of the needs of the public transportation industry that could be met through future investment in a national research and technology program." Specifically, it is tasked to advise FTA regarding "(a) the federal role in transit research . . . (b) high-priority opportunities proposed by the agency, and (c) processes that should be in place to ensure that FTA receives the input and cooperation of transit research stakeholders." This report specifically addresses Task Item b, examining safety as a high-priority research area. After the presentations and discussion on August 19, the committee met in closed session on August 20 to deliberate on its findings and recommendations for this report, which was completed over the course of several weeks through correspondence and then reviewed by an independent group of peers in accordance with the policies and procedures of the National Research Council. The assessment and recommendations of this report represent the committee's best collective judgment based on the information provided and discussed at the meeting.

The next section provides a brief overview of transit rail's safety record. It is followed by a summary of the presentations and discussions of August 19 and TRAC's observations and recommendations. The report concludes with a summary of the initial plans, informed by TRAC's discussion with you and Bruce Robinson, for subsequent committee meetings and topics for similar follow-on technical sessions.

BACKGROUND

Rail Safety

The tragic crash of the two WMATA trains in June 2009 marred what is otherwise a remarkable success story in transportation safety. According to a recent FTA report on transit rail safety, rail fatalities per 100 million passenger miles were about 0.02 in 2008, which is more than twice as safe as transit bus, 10 times safer than aviation, 20 times safer than ferry, and 70 times safer than travel by automobile.¹ For the 6 years preceding the WMATA crash, no onboard passengers in the United States had been killed in rail transit as a result of a collision or derailment. Of the 14 passenger deaths between 2003 and 2008, six were medically related, five were the result of imprudent customer behavior, and three were caused by slips and falls. All other deaths involving transit rail operations were of workers and others who were not rail passengers. Between 2003 and 2008, there were 468 deaths: 180 suicides; 116 trespassers struck by trains; 62 victims of accidents in stations or other rail property; 39 pedestrians (nontrespassers) struck by trains; 34 motorists killed in collisions with light rail vehicles; 13 members of the public who suffered single-person accidents; 10 right-of-way workers struck by trains; 10 people who fell from or were struck on platforms; 5 workers who suffered accidents at work sites; 3 workers who died of medically related causes; and 1 operator killed in a collision.² Despite the generally solid record of rail passenger safety, there is a legitimate reason to be concerned about the direction of the trend in rail transit accident rates (Figure 1). Accident rates have been steadily increasing in all major categories other than fires (nongrade crossing collisions; grade crossing collisions; other; and derailments) in recent years.³

¹ *2009 Transit Rail Safety Report*, Office of Safety and Security, Federal Transit Administration, U.S. Department of Transportation, Washington, D.C., Figure 2.

² *2009 Rail Transit Safety Report*, pp. 2–3.

³ *2009 Rail Transit Safety Report*, p. 4.

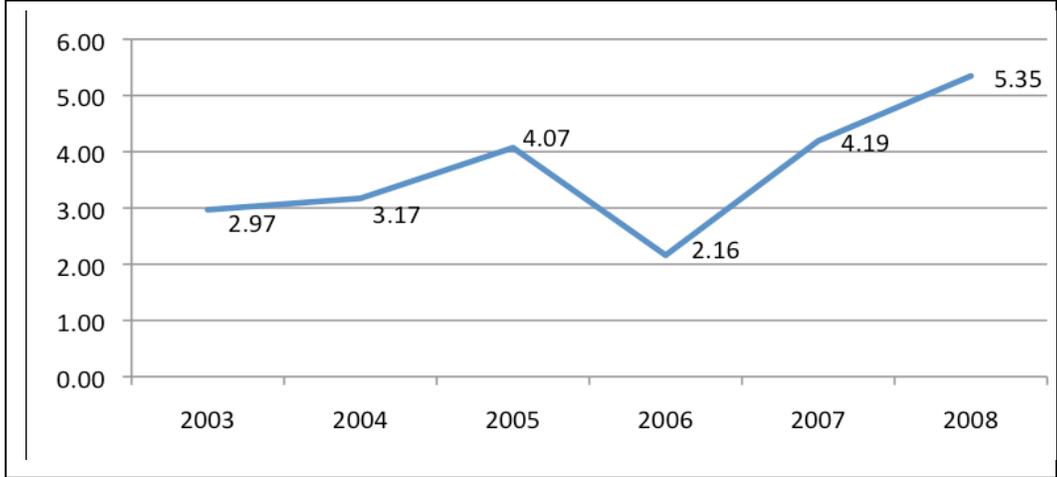


Figure 1: Rail Transit Accident Rates per 100,000,000 passenger miles, 2003–2008.⁴

Under current federal law, oversight of rail transit safety is the responsibility of individual states. Following the WMATA crash, and in light of the apparent shortcomings in oversight by the three units of government that oversee its safety operations (the District of Columbia, Maryland, and Virginia), Congress is contemplating giving FTA authority to regulate the safety of individual transit properties. By implication, such authority would also affect FTA’s safety research activities. Currently, the vast majority of the agency’s research, development, and technology activities address alternative-fueled vehicles, largely because of earmarking of research funds. In recent years, FTA’s National Research and Technology Program budget has typically averaged between \$40 million and \$50 million annually, but most of these funds are earmarked, limiting FTA’s discretionary programming of research. As you know, TRAC has repeatedly expressed concern over the effects of earmarking on FTA’s research capabilities. Indeed, you informed the committee that only about \$1 million is available annually from FTA’s

⁴ 2009 Rail Transit Safety Report, p. 3.

discretionary share of its research program to expend on safety research for rail and the other transit modes.

Bus Safety in Comparison to Rail Safety

Rail transit accidents draw more public attention and concern than bus accidents, perhaps because rail accidents are rare events, are exposed to few elements outside of operator control, and can involve multiple casualties. That said, with fatality rates almost double that of transit rail, bus safety would appear to deserve higher priority.

Unlike the referenced report on Transit Rail Safety, FTA has not produced a comprehensive assessment of bus safety in recent years. Data reported on FTA's website from the National Transit Database (NTD) indicate that in the most recent year for which data are reported (2007), there were 85 fatalities and roughly 12,400 injuries associated with bus transit.⁵ Both the absolute numbers of deaths and injuries and total bus transit passenger miles reported on the website have remained fairly stable over the past 10 years, suggesting that bus fatality and injury rates have remained stable as well. The website has almost no information on the causes of bus transit deaths and injuries, although presumably some of this information can be gleaned from the reports of deaths and injuries submitted by transit operators to NTD.

OVERVIEW OF TECHNICAL SESSIONS

The presentations given on August 19 were grouped in three sessions. The first session addressed the current status of transit safety and safety research and identified some key issues. The second session addressed research on safety culture, human factors, and safety management systems. The third session covered a case study of a transit property (MTA Metro-North Railroad) that has made significant advances in improving worker safety. Related to this case study was a separate presentation on how data collected at Metro-North for other purposes could be used to enhance safety

⁵ 2007 Transit Safety and Security Statistics, <http://transit-safety.volpe.dot.gov/Data/Samis.asp>. Accessed August 25, 2010.

management; the presentation also covered potential areas of research in worker fatigue and fatigue management and data and research to inform the development of heavy and light-rail crashworthiness performance standards. Highlighted in the following subsections are some of the things we learned that could be helpful to FTA in considering topics to pursue in safety research and that inform our findings and recommendations.

Session 1: Transit Safety Research: Current Status and Key Issues

Michael Flanigon, Director of FTA's Office of Safety and Security, provided an overview of rail safety (summarized in the previous section) and rising accident rates in rail transit, including increased collisions, grade crossing accidents, and mainline derailments as well as increased deaths among right-of-way workers. Flanigon also mentioned a number of National Transportation Safety Board (NTSB) recommendations that FTA is addressing through safety research, including toxicological testing, rail vehicle crashworthiness, subway evacuation, and nonpunitive safety reporting systems. He closed his presentation with a request for "actionable safety research" from case studies, demonstrations, safety information systems, data mining, and safety technology development and transfer. We pick up on several of his suggestions in our findings and recommendations later in this report.

Ed Watt, Director of Health and Safety of the Transport Workers Union of America, provided advice to FTA on how it should approach a rail safety regulatory process. He commented on the role that safety advisory committees play in the development of consensus regulations in aviation and railroads, discussed practices to improve safety based on management-labor cooperation, provided a stellar example from 2007 (New York City Transit Authority) of labor and management cooperating to improve worker safety, and commented on practices that impede safety. As examples of the latter, he discussed strained labor-management relations that lead to distrust, managerial perspectives on worker motivation that can belittle worker reports of unsafe conditions, and pressures on managers to meet on-time performance requirements that can undermine safety. He asked some fundamental questions, such as how to create a

safety culture that ensures that managers and workers follow rules for safe operation, how to find the right balance between operational and safety goals, and how to incentivize operators and employees to do more than simply strive for compliance with safety rules and regulations. We reflect these concerns in our findings and recommendations.

Amber Reep, Center for Urban Transportation Research (CUTR), University of South Florida, reported on different examples of CUTR research in transit safety and on how the results have been implemented in practice. Her examples included empirical analysis of the causes of most bus collisions and strategies to reduce them, research that identified data collection and analysis gaps that resulted in the development of incident-reporting software for Florida transit properties, and development of simulator training to maintain worker vigilance. Reep also stressed the need for research on fatigue, wellness programs, and drug and alcohol testing and mentioned the growing concern about commonly abused prescription medications that can affect worker performance. She cited the need for research to document whether the latter concern is an issue in transit.

The work at CUTR illustrates how the work of a university transportation center (UTC) can contribute to FTA safety goals and complement FTA research and development (R&D) plans. (Interestingly, CUTR's work on bus collisions was apparently funded by the Florida Department of Transportation.) Conversation during the question-and-answer period implied that although there are many UTCs, few appear to be doing research in transit safety. A subsequent scan of TRB's Research-in-Progress database confirmed few records of ongoing or recently completed UTC research in transit safety. Of note, however, is an important project by Portland State University researchers that merges bus transit incident data with archived intelligent transportation system (ITS) operational reports and human resources data.⁶ The University of California, Berkeley, has also conducted research on safety assist technologies for buses with support from

⁶ J. Strathman, P. Wachana, and S. Callas. Analysis of Bus Collision and Non-collision Incidents Using Transit ITS and Other Archived Operations Data. *Journal of Safety Research*, Vol. 41, 2010, pp. 137–144.

the California Department of Transportation. Patrick Sherry, a subsequent presenter in Session 3, reported on research he has conducted on railroad worker fatigue issues at the University of Denver, also a UTC.

Session 2: Research on Safety Culture, Human Factors, and Safety Management Systems

In its report on the probable causes of the 2009 WMATA crash, NTSB cited, among other problems, “evidence of an ineffective safety culture within the organization.”⁷ Two of the presentations in Session 2 addressed safety culture, as described below.

Kristen Bell, Behavioral Science Technology (BST), gave a presentation on safety culture and research. BST has conducted research on facets of organizations that its analysis indicates are components of safety culture. Bell acknowledged that there are different definitions of safety culture and that it is hard to measure, but also pointed out that shared values, beliefs, and assumptions within organizations directly affect how they perform. Organizational characteristics that reflect individuals’ values, beliefs, and assumptions can be measured through surveys. She also reported on BST research examining the connections between safety leadership, culture, systems, and performance. Although some aspects of safety culture are understood, Bell pointed out topics not understood that require more research, including descriptive studies of safety culture in transportation, correlations between regulatory systems and organizational safety performance, and intervention studies on how government agencies can influence organizational cultures across an industry.

Barry Strauch, Office of Marine Safety, NTSB, reflected on the importance of safety culture and the difficulties in measuring it and provided his judgment about the elements of a good safety culture and practices. He concluded that indicators of a good culture

⁷ National Transportation Safety Board, *Railroad Accident Report: Collision of Two Washington Metropolitan Area Transit Authority Metrorail Trains Near Fort Totten Station* Washington, D.C, June 22, 2009. NTSB Number RAR-10/02. NTIS Number PB2010-916302, 2010.

include a nonpunitive system of identifying and reporting safety concerns, a commitment to identifying and responding to deficiencies, and incorporation of risk identification and mitigation in operational practices. Practices that are important include a self-reporting system, investigation of incidents, responding to identified deficiencies and analyzing them, and responding to trends in unscheduled maintenance. He also observed that even organizations with excellent safety records can become less safe as a result of routine operating pressures and complacency.

Ralf Resch, European Centre of Employers and Enterprises Providing Public Services (CEEP), gave a contrasting presentation on a major focus of European transit safety research dealing with train control systems. In the European Union, advanced train control systems in different nations were being developed as proprietary systems. The research initiative that Resch described was designed to develop functional specifications that would permit open competition for developing, implementing, and operating such systems and create greater consistency across operators and borders. A component of this research program conducted a detailed assessment of safety approaches in safety-critical industries, the role of human factors in urban rail system safety, and use of accident/incident analysis among rail operators. Although different in orientation, given the research underway in the United States on train control systems and the failures of track circuits at WMATA that led to the 2009 collision, this research may be helpful to FTA, the Federal Railroad Administration (FRA), and U.S. railroads implementing train control systems.

Session 3: Transit Safety Research: Contributions to Safety Culture, Identification of Data Needs, and Contribution to Standards Development

Session 3 included a set of presentations that addressed identifying data needed for safety analysis, how it can be obtained, and important areas for future research.

Mark Campbell and Bill Parsons, both retired from MTA Metro-North Railroad, reported separately on the remarkable turnaround of Metro-North's safety record over several years and how the organization had become data driven toward safety goals. Campbell

provided an overview of what Metro-North had accomplished and how it had done so. He also gave examples of how the organization had improved and used safety-relevant data. Parsons explained how the organization had built safety-relevant information from other regulatory requirements for inspections and employee testing and had done so with a paperless system. [Regarding bus system safety, Portland State University researchers have shown (at TriMet) how to build a database for safety analysis using incident and accident reports, archived ITS operational data, and crew records and then how to use that data to identify areas of risk.⁸] Campbell's and Parsons' presentations and the research at Portland State illustrate the potential for case studies to inform transit managers about best practices.

Patrick Sherry, University of Denver, provided an overview of fatigue risk management plans, assessment, and analysis and the status of research and understanding in these areas, particularly in reference to their use by freight railroads and Amtrak. He identified important researchable topics such as the need to determine the effectiveness and cost-effectiveness of fatigue management systems being used in the railroad industry, the need to calibrate models developed for predicting and managing crew fatigue in freight rail for application in transit rail, and the need to understand the role of management and supervision in fatigue management. Should FTA become a safety regulator, it may well benefit from adapting and translating this research to rail transit.

Martin Schroeder, American Public Transportation Association (APTA), provided an overview of occupant protection research and vehicle crashworthiness standards in passenger rail. His presentation identified many areas of analysis required to develop performance standards, including occupant protection, protection of roadway vehicle occupants from being struck by trains, improvements to vehicle interiors, and overarching topics such as seat design, materials performance in crashes, and fuel tank risk from crashes. Also covered were standards development influenced by proposed

⁸ Strathman et al., Analysis of Bus Collision and Non-collision Incidents Using Transit ITS and Other Archived Operations Data. (See note 6.)

research on high-speed mainline equipment, bumper designs, guidelines for standing passengers, fuel tank design, and use of alternative materials for all standards.

OBSERVATIONS

The committee has two observations that are offered as important in setting the context for the research recommendations that follow:

1. Safety assurance is often cited as the top priority of transportation providers; however, because it is not the only goal of passenger transportation, the safety imperative must be understood and managed in a broader context. The central purpose of all passenger transportation systems is to move people, but doing so involves some level of risk. The challenge for both transit providers and regulators is to minimize safety risks while maintaining desired levels of service that are reliable and efficient. If transit providers allow service reliability to degrade, for example, by failing to maintain enough equipment to meet schedule demands, they risk losing customers, who may opt to travel on other modes, including those that are inherently less safe.

It is a practical reality that meeting these maintenance and service requirements is often complicated by budgetary pressures on transit agencies. Transit systems around the country are faced with having fewer and less consistent financial resources even as ridership demands are growing. Because of increasing operating deficits, many agencies are laying off workers and making cuts in service. Equipment that is reaching or has reached the end of its projected service life is not being replaced as fast as might be desired. FTA has reported that rail infrastructure condition is generally improving, but largely because of the recent introduction of new services in some communities. The agency reports that in seven of the largest systems, which account for the vast bulk of passenger trips, 35 percent of assets were in poor or marginal condition.⁹ These seven properties are in Chicago, Illinois; Boston, Massachusetts; New York; New Jersey; San

⁹ U.S. Department of Transportation, Federal Transit Administration, *Rail Modernization Study: Report to Congress*, Washington, D.C., April 2009, p. 2, http://www.fta.dot.gov/documents/Rail_Mod_Final_Report_4-27-09.pdf.

Francisco, California; Philadelphia, Pennsylvania; and Washington, D.C. They include the oldest transit rail systems in the country. It bears noting that most reported injuries due to derailments in recent years were caused by poor maintenance or equipment failure.¹⁰

2. FTA's discretionary R&D budget devoted to safety, totaling some \$1 million per year, seems to be out of synch with the many safety-related recommendations from NTSB and the pending federal legislation that could create substantial new government safety regulatory responsibilities. In light of safety's importance, one can make a strong case that FTA should always have a substantial investment in safety R&D. An even stronger case can be made if FTA becomes a safety regulator, in which case it will almost certainly need R&D to inform its safety rulemaking and oversight responsibilities. Indeed, one would expect that the elevation of safety as an agency mission would lead FTA to program more of its discretionary resources for safety research. By way of comparison, FRA's main function is to regulate the safety of railroad operations. FRA's safety R&D program is typically in excess of \$20 million annually. One would expect that much of FTA's safety research would be geared to meeting the needs of FTA if it, too, were to become a safety regulator and that more than \$1 million annually would be required. Of course, it is important to keep in mind that other federally funded research programs, such as the Transit Cooperative Research Program (TCRP) and the UTCs, sponsor transit safety research. Examples of UTC research in transit safety are cited above. Recent TCRP safety projects have addressed, or are addressing, light rail safety practices, safety rule compliance, transit safety culture, crashworthiness, pedestrian safety, fitness for duty testing, and other relevant topics. RDI would presumably have a keen interest in the TCRP and UTC work, ensuring that it reinforces and complements the agency's own safety research efforts.

¹⁰ 2009 Rail Transit Safety Report, p. 28.

RECOMMENDATIONS

The committee's recommendations are drawn from the presentations and the discussions that followed and from individual members' judgment about promising areas for R&D activities.

1. FTA should consult with APTA on the merits of developing a standard for reporting uniform safety data that could inform safety performance standards.

Understanding transit safety needs and priorities requires good data on system safety performance, which is currently lacking. In the question-and-answer period following the first session, participants expressed reservations about the quality of the safety statistics currently reported to NTD. Without reliable records of transit accidents, injuries, and fatalities, it will be very difficult to set priorities for policymaking and regulation and for supporting research to inform them. It appears that one issue with NTD reporting is reticence on the part of many transit workers and managers to report some accidents because of concerns that incidents will be found to involve rule violations and agency liability. Another issue is that hundreds, if not thousands, of different individuals from transit properties submit information, and apparently many are not fully aware of the reporting requirements and definitions, making for a great deal of reporting inconsistency.

If FTA were to become a regulatory agency, it would be preferable for its standards to be based on well-defined and measurable levels of safety performance, which would allow operators to find the most effective means for achieving those levels consistent with, or even exceeding, the standard. Indeed, many proposals for surface transportation reauthorization emphasize the need to shift to a performance-based system. The merits of developing a consensus-driven standard for safety reporting is that it would require all the relevant parties, labor included, to come to agreement about what should be reported and what the appropriate definitions should be. The aim should be more candid and reliable reporting that leads to more consistent data, providing the quantitative foundation for FTA and transit providers to assess safety needs and establish regulatory and research priorities. Should FTA move toward safety

performance regulations, the standard presumably would need to take into account differences between agencies in various factors such as capital condition, operating demands, and agency financial conditions. Although how this could be done is not immediately obvious, it might require the grouping of properties by mode types and scale of operations, for instance.

2. FTA should consider using the analytic approach developed by FRA as a model for prioritizing investments in safety R&D. During TRAC discussions, you and Bruce Robinson asked for guidance on how best to allocate FTA's limited discretionary funds to meet transit safety research needs. Some years ago, a TRB committee that advises FRA on its R&D program proposed a process of selecting research projects that is driven by the potential safety benefits of each project.¹¹ The Volpe Transportation Systems Center subsequently refined this proposal into a systematic and quantitative decision tool. The idea that drove the committee's proposal was to emphasize projects that could yield the largest safety improvement relative to the investment required. In the proposed methodology, analysts would define the nature and size of a safety problem (e.g., number of deaths, injuries, property damage) that would be targeted by a proposed research project and then assess the expected research results in terms of their potential to mitigate the problem. FRA and Volpe have subsequently refined this approach into a decision guide that also gives weight to the research project's supporting role in rulemaking, relevance to NTSB recommendations, responsiveness to stakeholder input, and other considerations. Presumably, such an analytic tool could be helpful to FTA in weighing potential safety research topics, although the agency should rely on judgment and avoid attempting to over-quantify the level of estimated benefit to best suit its more limited research resources.

3. Recognizing the need for timely research to support new safety functions, FTA should consider using techniques that lead to early research results, such as syntheses and domestic and international scans of best practices, literature

¹¹ TRB Review of the High-Speed Passenger Rail and Safety-Related Programs of the FRA, Letter Report of January 25, 1999, <http://onlinepubs.trb.org/onlinepubs/reports/frard2.html>. Accessed August 26, 2010.

reviews, and case studies. FTA's interest in timely research processes and results, as emphasized in discussions with TRAC, is understandable given the pending legislation and potential for many new safety-related functions. The goal of producing early results should therefore shape the agency's near-term R&D investment strategy. Examples of research projects that could be completed quickly include the following:

- Documenting safety best practices and developing a methodology for determining best practices that could have immediate payoff. The Metro-North and New York City Transit labor–management cooperation examples discussed by the presenters are examples that could be reported on that would benefit transit managers and potential regulators if fully documented. Case studies of properties with strong safety cultures and effective practices should be supplemented with information about these agencies' on-time performance, age of assets, and funding status.
- Conducting a demonstration of a close-call reporting system that respects the anonymity of data providers modeled on the program implemented by railroad management and labor with FRA's support.
- Investigating the Research Advisory Committee (RSAC) process for developing industry participation and consensus development around proposed safety regulations that was developed for the railroad industry and is supported by FRA. Is this process a good model for transit? If so, how should it be implemented in the transit industry?
- Examining how to build data sources of safety indicators based on other operating practices and regulatory requirements, as illustrated in the Metro-North case presented at the meeting. The example from TriMet bus operations, which matched accident and incident records with archived ITS operations and human resources records, should also be considered as an example upon which to build.

Recommendations 4 and 5 identify other possible candidates for short-term research that could inform FTA policy development for its new regulatory role. Over time, a more

varied mix of short-term and longer term research would be expected as the regulatory program is developed.

4. FTA should systematically assess the state of transit safety data and examine how identifiable safety issues and trends can inform early decisions by policy makers about agency safety programs. FTA's recent report on rail safety is a useful assessment of trends and broad causes of accidents. It begins to disaggregate accidents into categories that can lead to countermeasures. It also highlights areas where most risk exists. Although its information about causes is not as good as might be desired, it does provide insight into the major types of injury-inducing events, such as suicide and trespassing. Unfortunately, a parallel report on bus safety risk is not available and may not be possible to produce, given the shortcomings in the quality of the reliability of the NTD data. Presumably, the collection of more reliable bus safety data for effective risk management would be an outcome of Recommendation 1 above, which urges development of a consensus-based data collection and report standard.

Such safety data are important because of the need to approach risk management in a cost-effective manner. Although examining specific, high-profile incidents can be instructive, having data that provide a more comprehensive picture of the state of safety in rail transit—including where risk factors may exist—is essential to informing broader regulatory policy. In addition to informing our knowledge of what the major risk categories are, research can also help inform our understanding of the potential for various strategies to mitigate this risk. It may be very difficult, for example, to substantially reduce the number of suicides (the largest number of fatalities in rail transit), but the data may yield information on countermeasures that can yield significant risk reduction per dollar expended.

5. FTA should study and learn from FRA's research in support of its safety mission regulating freight and commuter railroads on topics ranging from safety culture, crew fatigue, and human factors to railroad grade crossing safety, train control, trespasser intrusion, and rail and wheel inspection. There are many

potential analogies between transit safety and freight and commuter rail safety. FRA has conducted a substantial body of research over the years to inform its regulations and to advise the railroad industry about safe practices. An early analysis that FTA could perform would be to determine which areas of FRA research would be most applicable to FTA's possible regulatory role of transit rail safety. FTA could learn to apply this analysis as it contemplates its approach to regulating transit safety.

6. FTA should examine the approaches used by other regulatory agencies to regulate work hours to reduce fatigue-related accidents. Other regulatory agencies have addressed work hours extensively, including FRA, the Federal Motor Carrier Safety Administration, and the Federal Aviation Administration (FAA). A recent example would be the Notice of Proposed Rulemaking on crew scheduling issued by the FAA in September 2010.¹² Although there are obvious differences between working conditions across modes, the underlying research and analysis is similar and should be informative to FTA.

7. Recommended areas of longer-term research that emerged from the session are listed below. While some of these topics might be pursued by FTA, its limited resources may require that FTA encourage TCRP and the UTCs to undertake many of them.

- Policy analysis is needed to define the highest priorities in transit safety and to identify the techniques that exist to address these issues, what their barriers to implementation are, and how they might be overcome.
- Research is needed to bridge the gaps between what is known about safety culture and the regulatory approaches that would best foster the desired safety outcomes. Even though there is debate about how to define safety culture, researchers appear to understand how to study aspects of safety culture that

¹² Flightcrew Member Duty and Rest Requirements; Proposed Rule. *Federal Register*, Vol. 75, No. 177, pp 55852-55889.

provide good indicators of organizations' commitment to safety. What regulatory regime is best at fostering organizations committed to safety?

- It appears that leadership and commitment of transit chief executive officers are critical to creating effective safety cultures, but it is also the case that top leaders in transit tend to have relatively short tenures. Given changes in top leadership, how can properties instill a safety culture that lasts?
- Existing models for mitigating fatigue from various crew-scheduling regimes need to be extended for assessing the risks of longer work schedules and nighttime schedules than they were originally calibrated for.
- Study is needed to determine which fatigue management systems are most effective and most cost effective.
- Discussion at the meeting indicated that even employees with years of safe operation can have lapses that increase the risk of crashes. The potential effectiveness of using simulator training to maintain operator vigilance and renew skills should be analyzed.
- An assessment is needed of the merits of relying on probabilistic risk analysis to guide risk management at the property level. The overall excellent safety record with respect to rail transit collisions and derailments implies that it is not enough for properties to simply rely on historical data, especially when a single event can result in multiple casualties. What can FTA learn from how safety is managed in other industries that also face a safety problem with low probability and high consequences? What indicators of safety (age of equipment, equipment failure rates, measures of crew fatigue, experience and training of crews, and so forth) would inform prudent risk management?

Although the research topics identified above do not include a complete listing of all the ideas discussed at the meeting, they are ones that TRAC believes deserve priority.

CLOSING COMMENTS ON NEXT STEPS

On behalf of the committee, I would again like to thank the FTA staff, along with all the presenters, for providing a very stimulating and productive set of presentations and

discussions. I trust the results will be useful to you and your staff. Although TRAC has often organized technical sessions for FTA in past meetings, these sessions have tended to be shorter in duration and have addressed a more focused set of topics. This was the first meeting organized around a full day of presentations and discussion. The committee shares the enthusiasm for this format that you indicated at the close of the open session.

As discussed with you, the next area of focus for TRAC will be on the rider experience, including that of riders with disabilities, and will address what is now known and needs to be better understood about the factors that attract riders on fixed-route and paratransit services and keep them riding. TRAC therefore proposes meeting with you and Bruce Robinson again in early December to develop the agenda in greater detail, with some straw man options for how the sessions might be organized, with the intent to holding the next meeting in March or April 2011.

Sincerely,

A handwritten signature in cursive script that reads "J. Barry Barker".

J. Barry Barker, Chairman

Attachment



Transit Research Analysis Committee

Transit Safety Research

Agenda

Keck Center of the National Academies
500 Fifth Street, NW
Washington, DC 20001
Room 101

Thursday, 19 August 2010

CLOSED SESSION (TRAC Committee and TRB Staff Only)

8:00 – 9:30 a.m. (with Continental Breakfast)
Committee Planning Session

OPEN SESSION

9:45 – 10:00 a.m.

Welcome and Introductions

Barry Barker, Chair, TRB Transit Research Analysis Committee

10:00 – 10:15 a.m.

Keynote Speaker

Therese McMillan, Deputy Administrator, Federal Transit Administration (FTA)

10:15 – 10:30 a.m.

FTA's Mission, Goals of the Workshop

Vincent Valdes, Associate Administrator for Research, Demonstration and Innovation, FTA

10:30 a.m. – 12:30 p.m.

FOCUS SESSION 1: Transit Safety Research: Current Status & Key Issues

Moderator: Les Hoel, TRAC Member

Panelists:

- ❖ Mike Flanigan, Director, Office of Safety and Security, FTA
 - Drivers/Inputs to Safety Research Needs (congressional, accident statistics, National Transportation Safety Board (NTSB) recommendations, industry input, etc.)
 - Examples of Successful Safety Research
- ❖ Ed Watt, Health and Safety Director, Transport Workers Union (TWU) of America
- ❖ Amber Reep, Program Manager, Center for Urban Transportation Research (CUTR), University of South Florida

Discussant: Greg Hull, American Public Transportation Association (APTA)

12:30 – 1:15 p.m.

Working Lunch in Meeting Room

1:15 p.m. – 3:15 p.m.

FOCUS SESSION 2: Research on Safety Culture, Human Factors, and Safety Management Systems and Their Implications for Transit Safety Research

Moderator: Anna Barry, TRAC Member

Panelists:

- ❖ Kristen Bell, Vice President, Research and Development, Behavioral Science Technology (BST)
 - Safety Culture in Transportation Organizations
- ❖ Barry Strauch, Chief, Major Investigations Division (Office of Marine Safety), NTSB

- Culture and Team Performance in Transportation
- ❖ Ralf Resch, General Secretariat, CEEP (The European Centre of Employers and Enterprises providing Public Services)
 - European Safety Programs and Research on Standardization in Public Transit, with Special Focus on Metros and Trams

Discussant: Ralf Resch, TRAC Member

3:15 – 3:30 p.m.

Break

3:30 p.m. – 5:30 p.m.

FOCUS SESSION 3: Transit Safety Research: Its Contribution to Safety Culture, Identification of Data Needs, Contribution to Standards Development, and Implications for Federal Transit Research Priorities

Moderator: Linda Bohlinger, TRAC Member

Panelists:

- ❖ Mark Campbell, Chief Safety and Security Officer, MTA Metro-North Railroad (retired)
 - A Case Study Example of the Uses of Safety Data in Support of a Successful Safety Culture Change
 - Some Thoughts on Enhancing the Utility of Safety Data
- ❖ Bill Parsons, Director of Regulatory Oversight, MTA Metro-North Railroad (retired)
 - Safety Data Needs (So. Cal. Metrolink Safety Peer Review and APTA examples)—Implications for Federal Regulation and Potential Research and Standards Development Needs
- ❖ Patrick Sherry, Professor, University of Denver
 - Safety vs. Fatigue Research and Application—Implications for Federal Regulation and Further Research

- ❖ Martin Schroeder, Chief Engineer, APTA
 - American Society of Mechanical Engineers (ASME) Heavy and Light Rail Crashworthiness Standards
 - Southern California Regional Rail Authority (SCRRA) Specification
 - Potential Future Performance-Based Approaches
 - Crash Energy Management Work Group Efforts

Discussant: Paul Jamieson, TRAC Member

5:30 p.m.

CLOSING REMARKS

Participant List

Committee

J. Barry Barker, Transit Authority of River City, *Chair*
Anna Barry, Massachusetts Bay Transportation Authority
Linda Bohlinger, HNTB Corporation
Barbara Cline, Prairie Hills Transit
Nathaniel P. Ford, Sr., San Francisco Municipal Transportation Agency*
Lester Hoel, University of Virginia
Paul E. Jamieson, Wabtec Corporation
Brian Macleod, Gillig Corporation*
Ralf Resch, European Centre of Employers and Enterprises Providing Public Services (CEEP)
Jeffrey Rosenberg, Amalgamated Transit Union
Linda Watson, Capital Metropolitan Transportation Authority, Austin, Texas*
Nigel H.M. Wilson, Massachusetts Institute of Technology*

Speakers and Discussants

Kristen Bell, Behavioral Science Technology
Mark Campbell, MTA Metro-North Railroad
Mike Flanigon, Federal Transit Administration (FTA)
Greg Hull, American Public Transportation Association (APTA)
Therese McMillan, FTA
Bill Parsons, MTA Metro-North Railroad

* **Not in attendance**

Amber Reep, Center For Urban Transportation Research, University of South Florida
Martin Schroeder, APTA
Patrick Sherry, University of Denver
Barry Strauch, National Transportation Safety Board
Vincent Valdes, FTA
Ed Watt, Transport Workers Union (TWU) of America

Other Attendees

Diaa A. Ahmed, Utrecht University
Roy WeiShun Chen, FTA
Martha Chow, Government Accountability Office
Lars Friberg, Attaché, Science and Innovation—Energy and Climate, Swedish Office of
Science and Innovation, Embassy of Sweden
Richard Gerhart, FTA
Judith Gertler, QinetiQ North America
Robin Gillespie, TWU
Levern McElveen, FTA
Kay Nordstrom, FTA
Thomas G. Raslear, FRA
Bruce Robinson, FTA
Louis Sanders, APTA
Mike Baltés, FTA

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Tom Menzies
Beverly Huey
Stephen Godwin
Rick Pain
Peter Shaw
Claudia Sauls
Amelia Mathis